Alberta's Program of Studies (Curriculum) - Mathematics - Shape and Space (Strand and Sub-strands)

Note: These strands are not intended to be discrete units of instruction. The integration of outcomes across trands makes mathematical experiences meaningful. Students should make the connection between concepts both within and across strands.

PROGRESSION IS HIGHLIGHTED IN THE FOLLOWING DOCUMENT VIA **BOLDED TEXT**.

MATHEMATICAL PROCESSES

There are critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and embrace lifelong learning in mathematics.

MATHEMATICAL PROCESS	Communication [C]	Connections [CN]	Mental Mathematics and Estimation [ME]	Problem Solving [PS]	Reasoning [R]	Technology [T]	Visualization [V]
Students are expected to	communicate in order to learn and express their understanding	connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines	demonstrate fluency with mental mathematics and estimation	develop and apply new mathematical knowledge through problem solving	develop mathematical reasoning	select and use technologies as tools for learning and for solving problems	develop visualization skills to assist in processing information, making connections and solving problems

Sub-strand: Measurement

General Outcome: Use direct and indirect measurement to solve problems.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
Specific Outcome *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*
1. Use direct comparison to compare two objects based on a single attribute, such as length (height), mass (weight) and volume (capacity). **[C, CN, PS, R, V]**	**1. Demonstrate an understanding of measurement as a process of comparing by:** • **identifying** attributes that can be compared • **ordering objects** • **making statements** of comparison • **filling, covering or matching**. [C, CN, PS, R, V]	**1. Relate the number of days to a week and the number of months to a year in a problem-solving context.** [C, CN, PS, R]	**2.** Relate the number of **seconds** to a **minute**, the number of **minutes** to an **hour** and the number of days to a **month** in a problem-solving context. [C, CN, PS, R, V]	**1. Read and record** time, **using digital and analog clocks, including 24-hour clocks.** [C, CN, V]	**1.** Identify **90º angles**. [ME, V]	**2.** Demonstrate that **the sum of interior angles is:** • **180° in a triangle** • **360° in a quadrilateral.** [C, R]	**1.** Demonstrate an understanding of **circles** by: • describing the relationships **among radius, diameter and circumference** • relating **circumference to pi** • determining the sum of the **central** angles • constructing **circles** with a given **radius or diameter** • solving problems involving the **radii, diameters and circumferences of circles**. [C, CN, PS, R, V]	**1.** Develop and apply the **Pythagorean theorem** to solve problems. [CN, PS, R, T, V] [ICT: P2–3.4]	**1.** Solve problems and **justify the solution strategy**, using the following circle properties: • **the perpendicular from the centre of a circle to a chord bisects the chord** • **the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc** • **the inscribed angles subtended by the same arc are congruent** • **a tangent to a circle is perpendicular to the radius at the point of tangency**. [C, CN, PS, R, T, V] [ICT: C6–3.1, C6–3.4]
		2. Relate the size of a unit of measure to the number of units (limited to nonstandard units) used to measure length and mass (weight). [C, CN, ME, R, V]	**1.** Relate the **passage of time to common activities**, using nonstandard and **standard** units (**minutes**, **hours**, **days**, **weeks**, **months**, **years**). [CN, ME, R]	**2. Read and record calendar dates in a variety of formats.** [C, V]	**4.** Demonstrate an understanding of **volume** by: • selecting and justifying referents for cm^3 or m^3 units • estimating **volume**, using referents for cm^3 or m^3 • measuring and recording **volume** (cm^3 or m^3) • constructing **right rectangular prisms** for a given **volume**. [C, CN, ME, PS, R, V]	**1.** Demonstrate an understanding of **angles** by: • identifying **examples of angles in the environment** • **classifying angles according to their measure** • estimating the measure **of angles, using 45°, 90° and 180° as reference angles** • determining **angle measures in degrees** • drawing and labelling **angles when the measure is specified**. [C, CN, ME, V]		**4.** Develop and apply formulas for determining the volume of right rectangular prisms, **right triangular prisms and right cylinders**. [C, CN, PS, R, V]	
		3. Compare and order objects **by** length, height, **distance around** and mass (weight), **using nonstandard units**, and make statements of comparison. [C, CN, ME, R, V]	**5.** Demonstrate an understanding of **perimeter** of **regular and irregular shapes by:** • **estimating perimeter, using referents for cm or m** • **measuring and recording perimeter (cm, m)** • **constructing different shapes for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter**. [C, ME, PS, R, V]	**3.** Demonstrate an understanding of **area** of regular and irregular 2-D shapes by: • **recognizing that area is measured in square units** • selecting and justifying referents for the units cm^2 or m^2 • estimating **area**, using referents for cm^2 or m^2 • **determining** and recording **area** (cm^2 or m^2) • constructing different **rectangles for a given area** (cm^2 or m^2) in order to demonstrate that many **different rectangles may have the same area**. [C, CN, ME, PS, R, V]	**2. Design** and construct different rectangles, given **either** perimeter or area, **or both (whole numbers)**, and **make generalizations**. [C, CN, PS, R, V]	**3.** Develop and apply **a formula for** determining the: • perimeter of **polygons** • area of rectangles • volume of right rectangular prisms. [C, CN, PS, R, V]	**2.** Develop and apply a formula for determining the area of: • **triangles** • **parallelograms** • **circles**. [CN, PS, R, V]	**3.** Determine the **surface area** of: • right rectangular prisms • **right triangular prisms** • **right cylinders** to solve problems. [C, CN, PS, R, V]	
		4. Measure length **to the nearest nonstandard unit by:** • **using multiple copies of a unit** • **using a single copy of a unit (iteration process)**. [C, ME, R, V]	**3.** Demonstrate an understanding of measuring length (**cm, m**) by: • **selecting and justifying referents for the units cm and m** • **modelling and describing the relationship between the units cm and m** • **estimating length, using referents** • measuring and **recording** length, **width and height**. [C, CN, ME, PS, R, V]		**3.** Demonstrate an understanding of measuring length (**mm**) by: • selecting and justifying referents for the unit **mm** • modelling and describing the relationship between **mm** and cm units, and between **mm** and m units. [C, CN, ME, PS, R, V]			**2.** Draw and construct **nets for 3-D objects**. [C, CN, PS, V]	
		5. Demonstrate **that changing the orientation of an object does not alter the measurements of its** attributes. [C, R, V]	**4.** Demonstrate an understanding of measuring mass (**g, kg**) by: • **selecting and justifying referents for the units g and kg** • **modelling and describing the relationship between the units g and kg** • **estimating mass, using referents** • measuring and **recording** mass. [C, CN, ME, PS, R, V]		**5.** Demonstrate an understanding of capacity by: • describing the relationship between **mL and L** • selecting and justifying referents for **mL or L** units • estimating **capacity**, using referents for **mL or L** • measuring and recording **capacity (mL or L)**. [C, CN, ME, PS, R, V]				

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Students are expected to	communicate in order to learn and express their understanding	connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines	demonstrate fluency with mental mathematics and estimation	develop and apply new mathematical knowledge through problem solving	develop mathematical reasoning	select and use technologies as tools for learning and for solving problems	develop visualization skills to assist in processing information, making connections and solving problems

Sub-Strand: 3-D Objects and 2-D Shapes

General Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
Specific Outcome *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*	**Specific Outcome** *It is expected that students will:*
2. Sort 3-D objects, using a single attribute. [C, CN, PS, R, V]	**2.** Sort 3-D objects **and 2-D shapes**, using one attribute, **and explain the sorting rule**. [C, CN, R, V]	**6.** Sort 2-D shapes and 3-D objects, using **two** attribute**s**, and explain the sorting rule. [C, CN, R, V]	**7.** Sort **regular and irregular polygons**, including: • **triangles** • **quadrilaterals** • **pentagons** • **hexagons** • **octagons** according to the number of sides. [C, CN, R, V]	**4.** Describe and construct **right rectangular and right triangular prisms**. [C, CN, R, V]	**6.** Identify and sort **quadrilaterals**, including: • rectangles • squares • **trapezoids** • **parallelograms** • **rhombuses** according to **their** attributes. [C, R, V]	**4.** Construct and compare **triangles**, including: • **scalene** • **isosceles** • **equilateral** • **right** • **obtuse** • **acute** **in different orientations**. [C, PS, R, V]	**3.** **Perform geometric** constructions, including: • **perpendicular line segments** • **parallel line segments** • **perpendicular bisectors** • **angle bisectors**. [CN, R, V]	**5.** Draw and **interpret top, front and side views of 3-D objects composed of right rectangular prisms**. [C, CN, R, T, V] [ICT: C6–3.4]	**2.** Determine the surface area of **composite 3-D objects to solve problems**. [C, CN, PS, R, V]
3. Build and describe 3-D objects. [CN, PS, V]	**3.** **Replicate composite 2-D shapes** and 3-D objects. [CN, PS, V]	**7.** Describe, compare and **construct** 3-D objects,including: • **cubes** • **spheres** • **cones** • **cylinders** • **pyramids**. [C, CN, R, V]	**6.** Describe 3-D objects **according to the shape of the faces and the number of edges and vertices**. [C, CN, PS, R, V]		**7.** Describe and **provide examples of** edges and faces of 3-D objects, and sides of 2-D shapes that are: • **parallel** • **intersecting** • **perpendicular** • **vertical** • **horizontal**. [C, CN, R, T, V] [ICT: C6–2.2, P5–2.3]	**5.** Describe and compare **the sides and angles of regular and irregular polygons**. [C, PS, R, V]			**3.** Demonstrate an understanding of **similarity** of polygons. [C, CN, PS, R, V]
	4. **Compare 2-D shapes to parts of 3-D objects in the environment**. [C, CN, V]	**9.** **Identify** 2-D shapes **as** parts of 3-D objects in the environment. [C, CN, R, V]							
		8. **Describe**, compare and **construct** 2-D shapes, including: • **triangles** • **squares** • **rectangles** • **circles**. [C, CN, R, V]							

Sub-Strand: Transformations

General Outcome: N/A				General Outcome: Describe and analyze position and motion of objects and shapes.					
Specific Outcome	**Specific Outcome**	**Specific Outcome**	**Specific Outcome**	**Specific Outcome**	**Specific Outcome**	**Specific Outcome**	**Specific Outcome**	**Specific Outcome**	**Specific Outcome**
N/A	N/A	N/A	N/A	**5.** Demonstrate an understanding of **congruency, concretely and pictorially**. [CN, R, V]	**8.** Identify and describe **a single transformation, including a translation, rotation and reflection of** 2-D shapes. [C, T, V] [ICT: C6–2.1]	**6.** Perform **a combination of** translation**s**, rotation**s** and/or reflection**s** on a single 2-D shape, **with and without technology**, and draw **and describe** the image. [C, CN, PS, T, V]	**5.** Perform and describe transformations (translations, rotations or reflections) of a 2-D shape in **all** four quadrant**s** of a Cartesian plane (limited to **integral** number vertices). [C, CN, PS, T, V] [ICT: C6–3.4]	**6.** Demonstrate an understanding of the congruence of polygons. [CN, R, V]	**4.** Draw and interpret **scale diagrams** of 2-D shapes. [CN, R, T, V] [ICT: C6–3.4]
				6. Demonstrate an understanding of **line symmetry by**: • identifying **symmetrical** 2-D shapes • creating **symmetrical** 2-D shapes • drawing **one or more lines of symmetry in a** 2-D shape. [C, CN, V]	**9.** **Perform, concretely, a single transformation (translation, rotation or reflection) of** a 2-D shape, **and draw the image**. [C, CN, T, V] [ICT: C6–2.1]	**9.** Perform and describe single transformation**s** of a 2-D shape **in the first quadrant of a Cartesian plane (limited to whole number vertices)**. [C, CN, PS, T, V] [ICT: C6–2.1]			**5.** Demonstrate an understanding of line and **rotation** symmetry. [C, CN, PS, V]
						7. Perform **a combination of successive** transformation**s** of 2-D shapes **to create a design**, and identify and describe **the** transformation**s**. [C, CN, T, V]			
						8. Identify and **plot points in the first quadrant of a Cartesian plane, using whole number ordered pairs**. [C, CN, V]	**4.** Identify and plot points in the **four** quadrant**s** of a Cartesian plane, using integral ordered pairs. [C, CN, V]		